USDA NRCS — Natural Resources Conservation Service

RUSLE2 - Instructions & User Guide

May 2004

Note: There is more help and instruction available within the RUSLE2 Program by clicking on the "Help" menu and selecting "users manual". For help with an individual cell in the program, place your cursor on that cell and right-click, then select "Help".

The following are the steps needed to install RUSLE2 and install the Climate, Soils, and Management databases.

Step #1 – Create a "RUSLE2" Folder

Create a folder in your C directory or in the My Documents directory and call it: **RUSLE2 Archive Folder**. This can be used now and in the future to store all the RUSLE2 files for later import and export files. *This separate directory is optiona, but can be useful to go back and retrieve databases without going to the RUSLE2 website.* The directory, C:/Program Files/usda/rusle2 is where RUSLE2 will be loaded.

Step #2 – Download Program and Databases or copy from CD

A. Go to the website http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm. This site contains the "**official"** NRCS version of RUSLE2 to download and the official NRCS databases to download and use. If available on a CD, simply copy the files from the CD to the **RUSLE2 Archive Folder** (or other file folder) that you created in Step 1.

B. Download the following from the above website and save it in your **RUSLE2 Archive Folder:**
   a) The **RUSLE2 program** (Click on the Download File under RUSLE2 Program File)
   b) The **NRCS BASE DATABASE IS INCLUDED IN THE RUSLE2 PROGRAM – NO NEED TO DOWNLOAD**
   c) The **Climate Database** for your state. (Click on the Data Files under CLIMATE)
   d) The **Crop Management Zone** files (e.g. CMZ 16) that covers your respective work area. If you are not sure which CMZ you need Click on the "Maps" under CROP MANAGEMENT TEMPLATES. Then download by clicking the "Crop Management Zone" link under Crop Management Templates).
   e) The **Soils database** for your state. After you download you will need to unzip the Soils Folder for your state. Unzip (extract) the soils folder to the same file folder. NOTE: you will need to double click on the state folder to open the folder to select your county database.

Step 3. Installing RUSLE2

A. Login as administrator. You need the administrator's password or have someone with administrative privileges do this for you. For more detailed instructions on installing RUSLE2 download RUSLE2 Installation Guide (3.6 mb) at the following site (in Adobe Acrobat format): http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Program.htm

B. Navigate to where you downloaded and saved the RUSLE2 program (**RUSLE2 Archive Folder)** and databases using Windows Explorer. NOTE: For a standard installation on NRCS CCE-compatible machines, select all defaults during installation.

   a. Double-click on the *R2NRCS_Date.exe* installer line and use the default settings. It is recommended you select create a "desktop icon" when given the choice. If you miss this step it can always be added later. If you fail to create a desktop icon for RUSLE2 you can find the program by clicking on Programs > USDA Applications.

b. The RUSLE2 program will be installed in the directory, ***C:/Program Files/usda/Rusle2***.

C. Log off as administrator and logon as yourself.

Step 4. Create a RUSLE2 Desktop Shortcut (OPTIONAL)

Open Windows Explorer. Navigate to C > Program Files > USDA > RUSLE2 > Binaries. In the Binaries file highlight then right click on the RUSLE.exe file. From the menu select Send To > Desktop (create shortcut).

Step 5 – Import Databases For Soils, Climate, Crop Management Zone Files

1st - Open the RUSLE2 Archive Folder where you saved the Soils Database, the Climate Database, and the Crop Management Zone (CMZ) files.

2nd - Copy the climate database file from your RUSLE2 Archive Folder and paste it into the "Import" folder in the C:/Program Files/usda/RUSLE2/imports folder. This is where the RUSLE2 import utility will look for this file. Repeat this process for the county(s) soils database files desired and the CMZ database(s).

3rd – If Needed, Download the import instructions and follow the instructions to import the databases into RUSLE2 for your specific use @
http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Instructions.htm

4th – Open the RUSLE2 Program
> A. You can open the RUSLE 2 program by clicking on the RUSLE2 icon on the Desktop. OR,

<div align="center">**Or**</div>

> B. Click on Start > Programs > USDA Applications > Select RUSLE2

5th - Go to the Database on the Main Menu of the RUSLE2 Screen, click on "Database" - Select "Import with templates, access…."
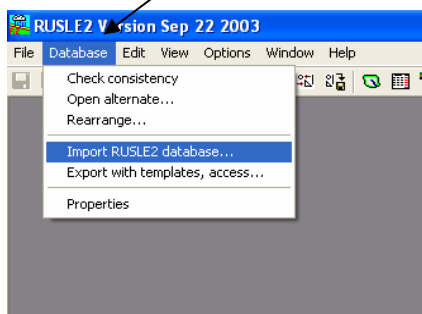
> **DATABASE:**
> **This is one of the most often used menu items.**
>
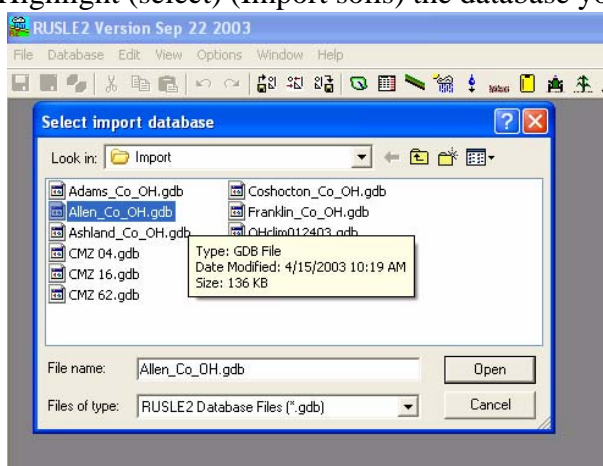> **The main items used here will be:**
> - **Import with Templates, access…We will use this one now.**
> - **Export with Templates, access…**

A. This is the <u>menu</u> used to import your climate, soils, and Crop Management Zone (CMZ) databases.

B. Click on "Import RUSLE2 database….

C. Highlight (select) (Import soils) the database you wish to import e.g. soils, Allen_Co_OH.gdb – then click Open.

D. Put a "check mark" next to soils and Allen_C0o_OH (On The LEFT Side of the Screen, under "Import Database" – this identifies the database to import.

E. At the bottom Left Corner, "Include dependent files" click on NONE.

F. On the right half of the import box "Installed Database, select "Import to same folder".

G. Click the "Import" button, this will take you through the database import process – sit back and wait until you get the successfully imported message.
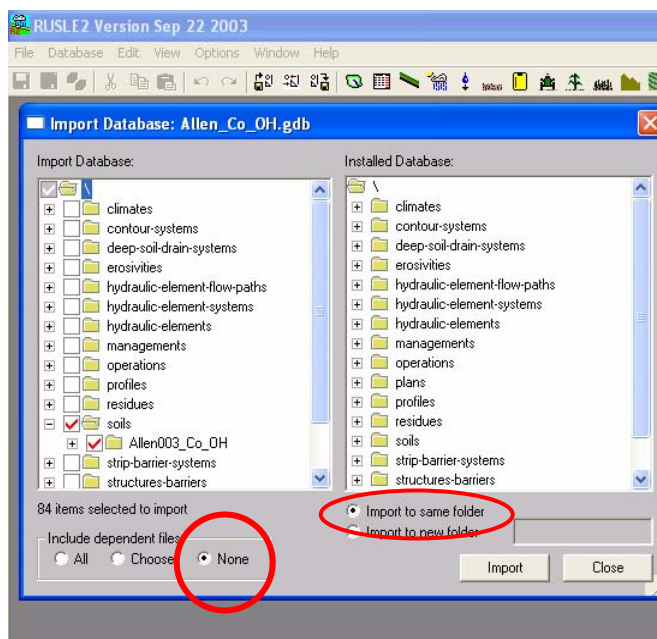
H. Repeat the A-G process for the OHClimDate.gdb databse – REMEMBER, when importing at the Import box shown above click the box next to "Climates" and the Ohio database to import. NOTE: All counties for Ohio will load – individual counties cannot be selected for climate.
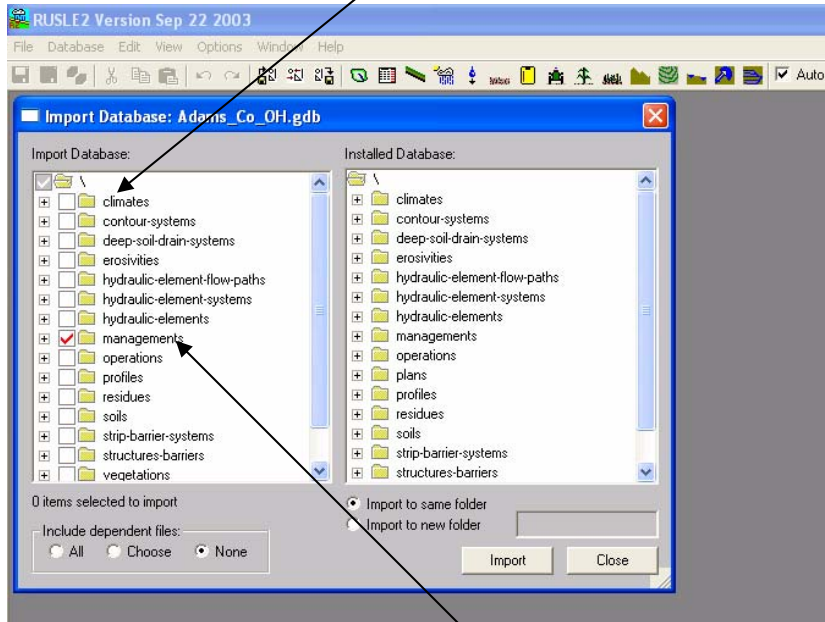
I. Repeat the A-G process for the CMZ_XX.gdb database – REMEMBER, when importing at the Import box shown above click the box next to "managements" and the database you wish to import.

J. CAUTION: Installing more than 6 County Soils Databases into RUSLE2 can slow down your RUSLE2 computer processing time. However, newer versions of RUSLE2 seem to overcome this problem.

K. After the databases are imported into RUSLE2 you are now ready to use the software to predict and evaluate sheet and rill erosion.

Using RUSLE2 - Introduction

Step 1. Start the RUSLE2 program.

In the opening screen select the "**Plan Description Worksheet**" user template (the green watershed symbol). This is the screen that can be used to calculate soil loss for multiple fields and print a summary report. We will use the "Plan Description Worksheet" template to provide instruction on how to use RUSLE2. The other worksheets follow a very similar process.
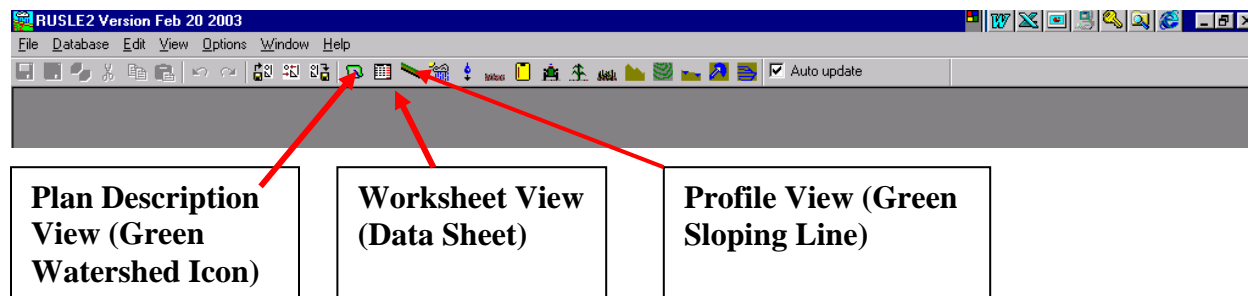
Plan Description View (Green Watershed Icon) - This is the template to use to calculate soil loss on multiple fields for conservation planning.

Worksheet View (Data Sheet) - This is a useful template to use to calculate several soil loss alternatives for one hillslope or one field.

Profile view (Green Sloping Line) - This template is used to make a single calculation of soil loss for one hillslope in one field. **NOTE**: This is also the template you will be directed to use when you want to build rotation management systems. When using the profile you will be able to save rotations you create in the local (c) CMZ file folder and use in the future to save entry time.

Step 2. Select a Starting File/Template.

In the "Open Objects From Plan" dialogue box click on the file you wish to start. If you are starting for the first time, select the default. Make sure you click hard enough that the [file name] appears in the name blank at the bottom of the dialogue box. Click Open.
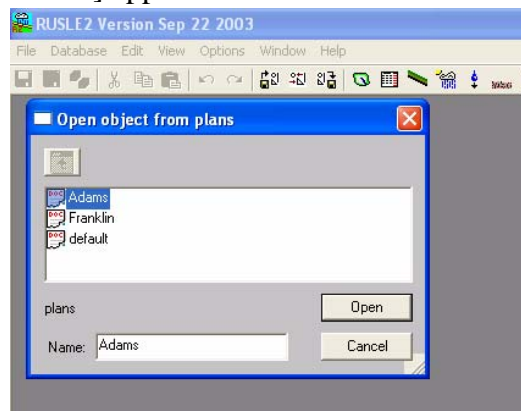
NOTE: If this is the first time you are starting do the following:
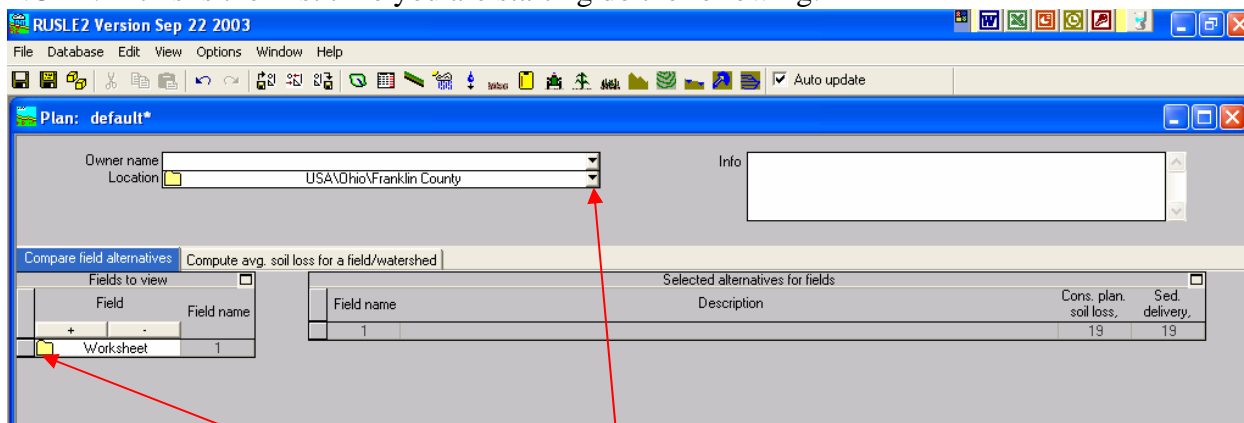
- Select a location using the drop down menu and opening the yellow climate folder – navigate until you find your county – DOUBLE CLICK the county e.g. Franklin County.
- Now click on the yellow "worksheet" folder. This will open the worksheet view to enter data – we want to set up the rest of the planning template for future use.
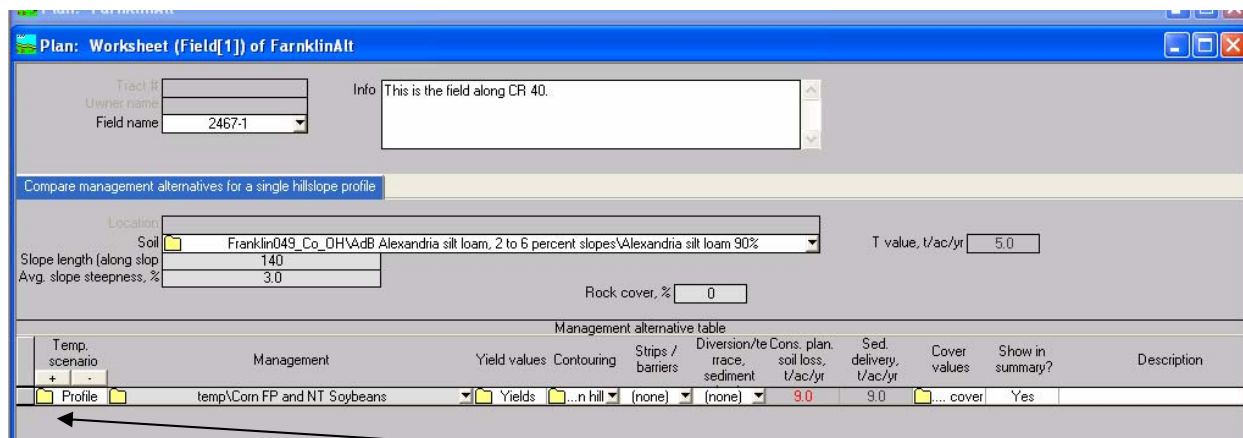
- Now click on the yellow folder next to "profile" – this will open the profile view.

At the General Yield Level box – use the dropdown menu and select **(set by user).**
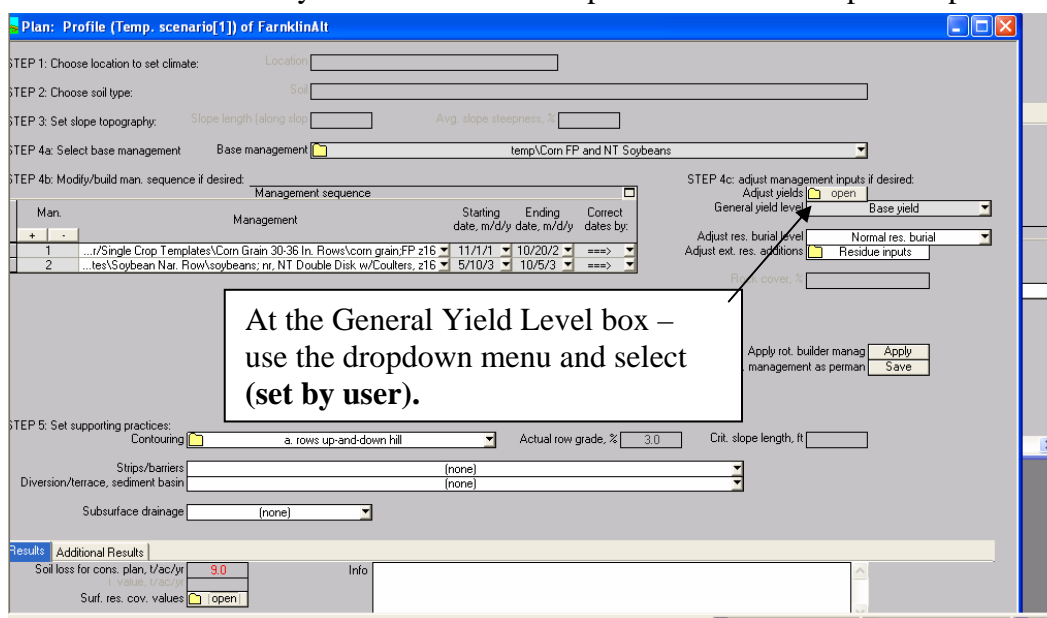
- Click the "X" in upper right to close the profile view.
- Click the "X" in upper right to close the worksheet view. You are now back at the "Plan View screen"
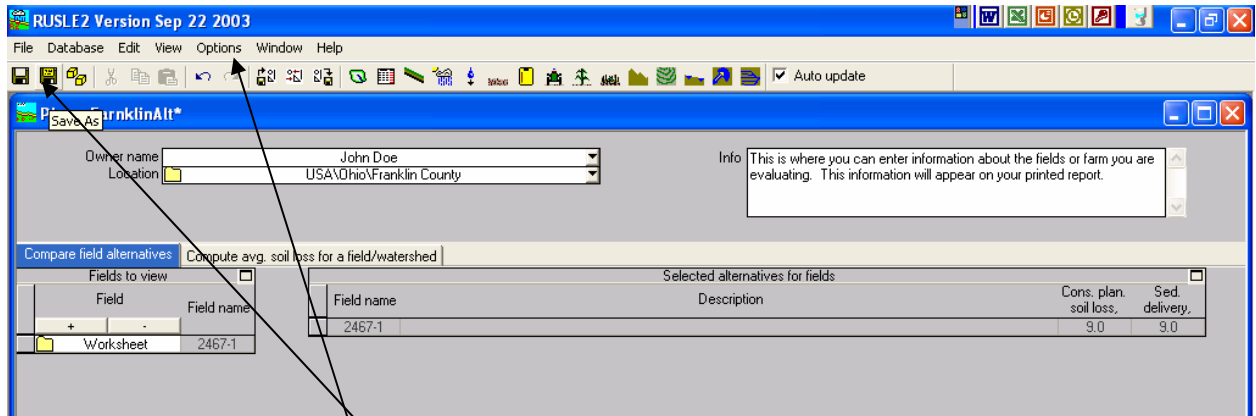
- Click on the File "Save As" choice or button and give the file (template) a name of the county or another name you prefer. Click Save.
- Now Click on the "Options" menu at the top of the screen. Select Template > Edit Current.
- In the "Startup Tab ", check the box next to "use this template on startup" if you want this one to start when you open the "Plan Descriptions Template". If not, do not check it.
- In the "General Tab" click "Highlight Selected Tab" and "Show Calendar…"
- Click OK

The "planning view template" is now set for your use.

Using RUSLE2 to Predict Sheet and Rill Erosion

Step 1. Owner Name or your Client. (On the "Plan View")
Click on the drop down arrow. A box will appear where you can type in the owner name.

Step 2. Climate Location. (On the "Plan View")
Click on the drop down arrow (IF NOT ALREADY SELECTED). Navigate down the files, open your state, then move down and double click on the county or climate file you want.

Step 3. Plan Info Box (Upper-Right of Screen) (On the "Plan View")
Place your cursor in the box and type a description of the fields or treatment units being evaluated. This will be helpful information for the future. The information entered here will appear in the Report Printout that will serve as your permanent record.
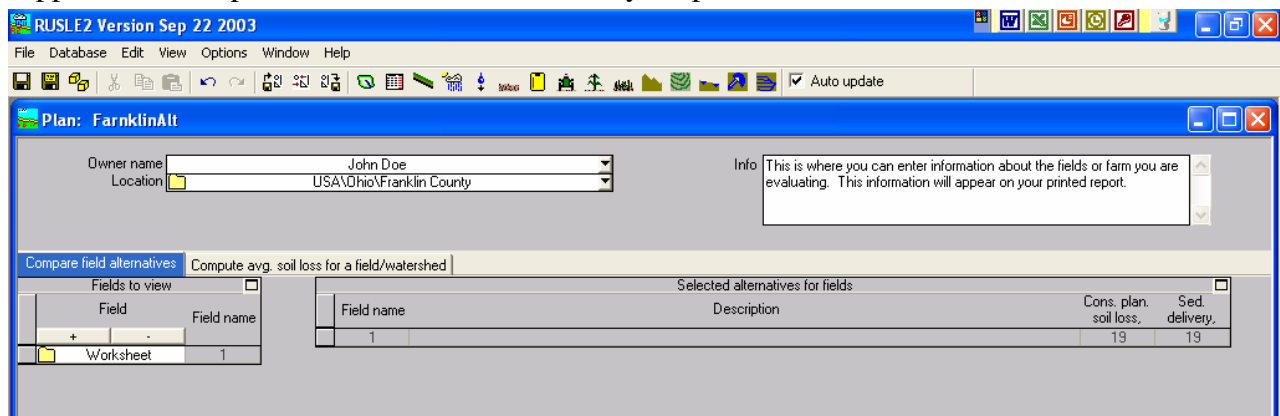
Step 4. Enter Fields and Field Names (Plan View)

1st. Click on the yellow folder next to Worksheet – this will open up the field worksheet view where you enter data about the field being evaluated.

2nd. Use the drop down menu (next to field name) and enter the "Field Name" e.g. North 40.
3rd. OPTIONAL – enter info about the field in the "Info" text box, if it will be useful for you later.

4th. **SOILS** -Use the Soil drop down menu to select the planning soil for this field. After you select the "County", next select the "Map Unit" and click the "+" sign to display the soil component. If there is only one soil component select it; if there is more than one soil component, select the one that best fits the field condition. Double click the Map Unit Component to enter.
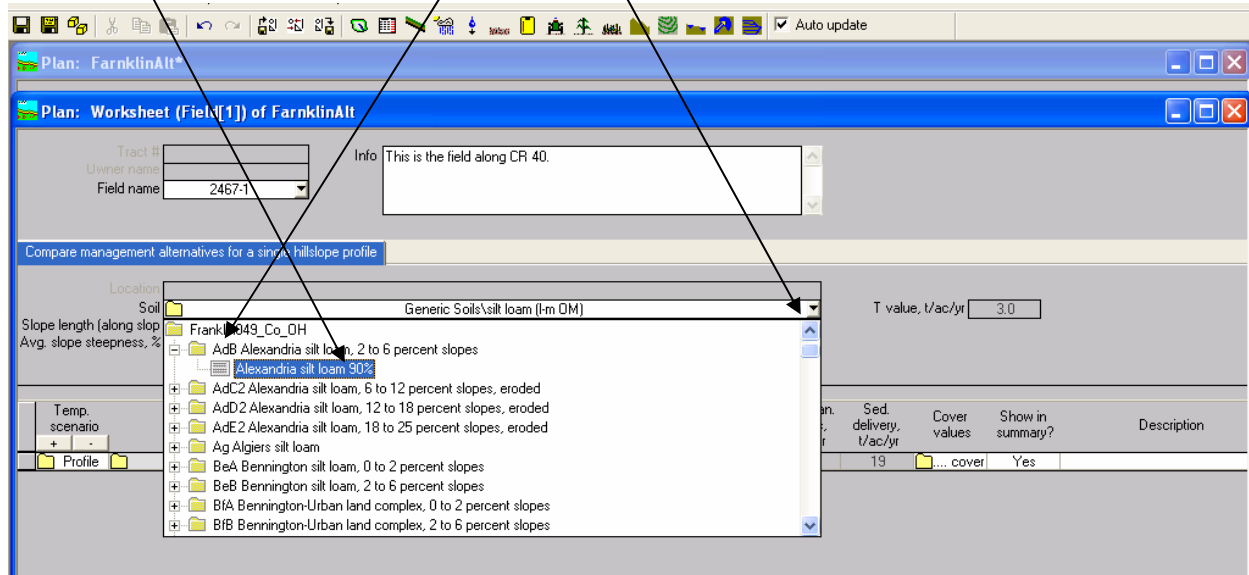
5th. Enter the **LENGTH OF SLOPE AND THE PERCENT SLOPE** that you measured in the field.
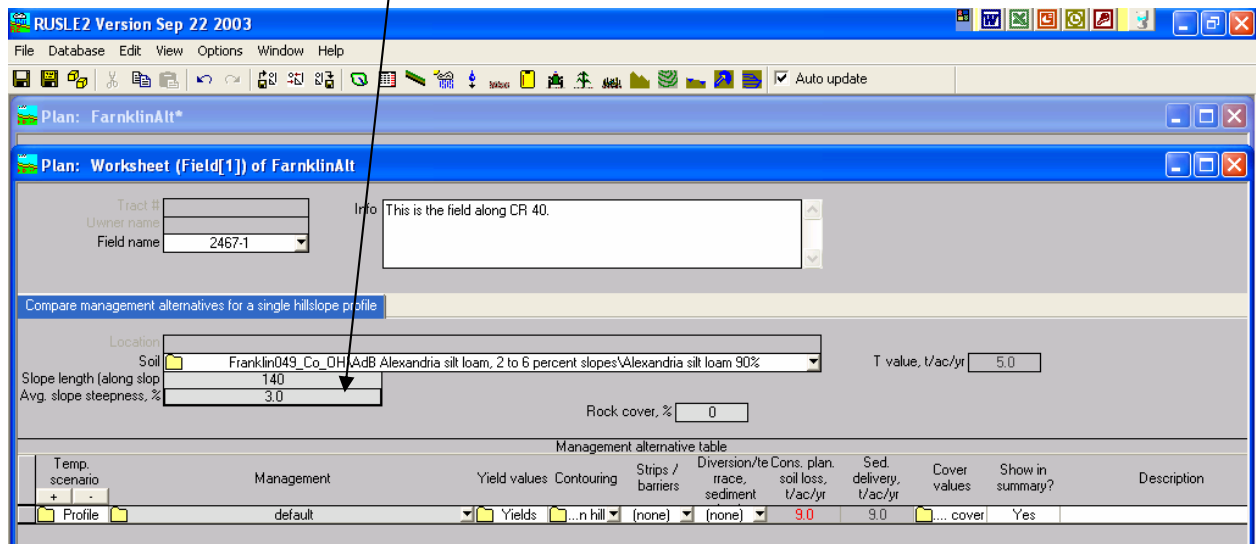
There are two (2) primary ways to enter management:
1. Build a rotation using single year crops or double crops, OR
2. Select a pre-built rotation and use as is or do minor revisions.

Option 2 is the easiest and quickest; however, the 6th step below will show how to build a rotation from single year crops. Selecting pre-built rotations will be shown at the end of this section.

6th MANAGEMENT - Entering and "**building a rotation from single year crops**".

- Double click on the yellow profile folder in the "Worksheet View". The profile screen shown below will appear.

- Start at step **4b Modify/Build** man sequence if desired.
- Click on the "+" sign under "Man" to add a row for each crop in the rotation. In the example above (2) rows are shown for a two year rotation (e.g. corn-soybeans).
- Under 4b. "Management" use the drop down menu in the first row to select the first crop e.g. Corn Fall Plow. Start by navigating to the appropriate CMZ e.g. CMZ_16, then go to the single year crops (**a. folder – Single Year Crops Templates**);(b. **Multiyear Rotation Templates -** folder is for already built rotations/tillage systems); (c. **Other Local Mgt. Records –** where users save rotation file/templates they built and wish to save for future use).

Then click on Corn folder and move down until you find (corn grain, FP z16) double click to enter.

No Till (double disk opener with coulter) Soybeans were added as the second crop. The starting and ending dates for both crops are shown. The "starting" date is the date of the first tillage operation for the crop or the planting date for no till. The "ending" date is usually the crop harvest date. **ALWAYS** check these date to ensure an extra year is not added and make sure the date of the following crop is at least one day later than the ending date of the previous crop.

- After the crops are entered and the dates are checked – click the "Apply" button.

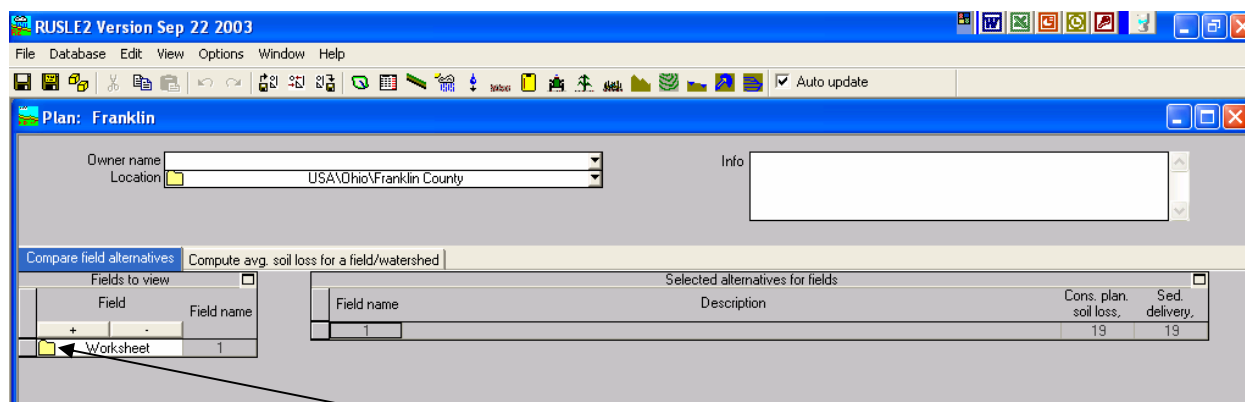- After the "Apply" button is clicked a dialogue box will appear where you can enter a file name (enter a descriptive name) for the rotation (NOTE: you will be able to save the rotation to use in other fields and farms). Click OK to save the temp file name.
- Now click the Save Button (under the "Apply Button") to save this file.
- Now click the "X" to close the Profile View, this will take you back to the worksheet view (shown below) where you can enter the other appropriate data for the field and slope.
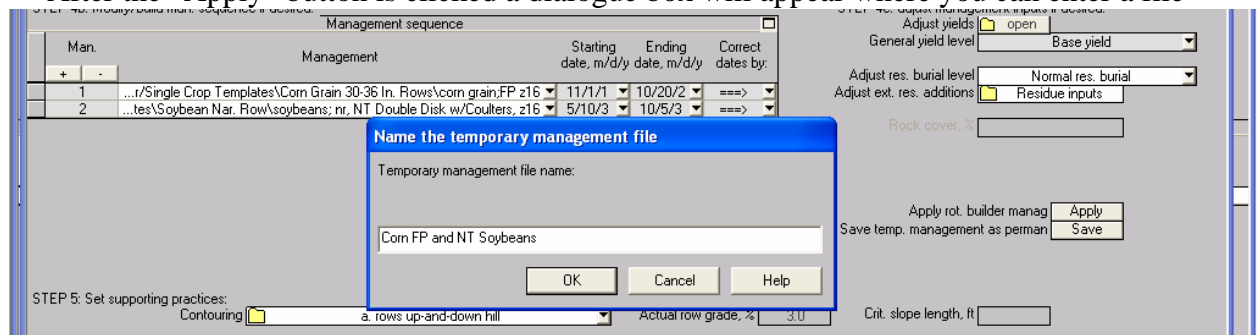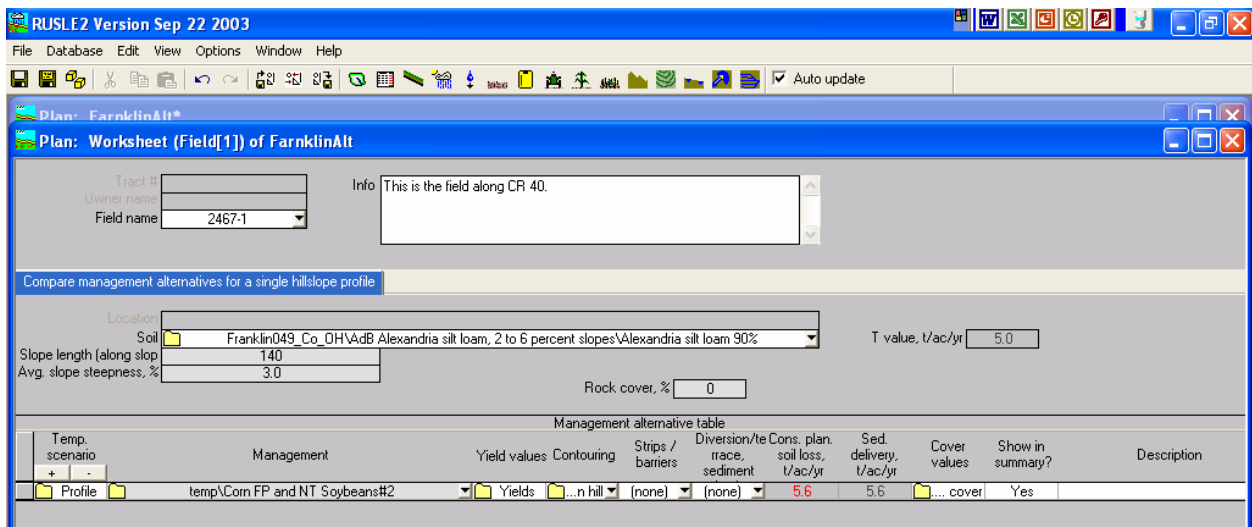
The next steps involve adjusting yields for the crops as needed, choosing the appropriate supporting practices (contouring, strips, terraces).

Entering "Management" by selecting pre-built rotations.

1st Open the "Plan View". Enter location if not already entered.
2nd Click on the yellow folder next to "Wooksheet" to open the Worksheet View.

Enter Field ID and Length and Slope as appropriate.

3rd. Click on the "Management" drop down menu.
• Navigate to the desired CMZ (CMZ 16 shown here).
• Open either the "b." folder Multiyear Rotation Templates, OR the "c." folder Local Templates.
• Navigate through the choice list until you find a system that fits your needs or close to it. You will be able to edit what you select to make it site specific.

Entering "Management" by selecting pre-built rotations.

1st Open the "Plan View". Enter location if not already entered.
2nd Click on the yellow folder next to "Wooksheet" to open the Worksheet View.

Enter Field ID and Length and Slope as appropriate.

3rd. Click on the "Management" drop down menu.
• Navigate to the desired CMZ (CMZ 16 shown here).
• Open either the "b." folder Multiyear Rotation Templates, OR the "c." folder Local Templates.
• Navigate through the choice list until you find a system that fits your needs or close to it. You will be able to edit what you select to make it site specific.

This is the selected rotation. You can view the operations in this rotation and add or delete if needed. To view click the yellow folder for the management. The screen below is displayed.

Management Screen showing the rotation's operations and crops.

Revising Operations in a Rotation:

In the example above if you wanted to show to field cultivator operation instead of the disk, tandem for 5/1/2 you would click on the drop down arrow next to disk, tandem. Navigate through the choice list to select Cultivator, field 6-12 in. sweeps.

In this example we now show to Cultivator, field 6-12 in. sweep operation for 5/1/2 and 5/5/2. Other operations can be modified, deleted, or added in a similar manner.

The next steps involve adjusting yields for the crops as needed, choosing the appropriate supporting practices (contouring, strips, terraces).

Step 1. YIELDS - Click on the yellow folder next to "yields". The "Adjust Yields" dialogue box below appears (in this example the corn was set @ 140 and the soybeans @ 45 bu/ac.
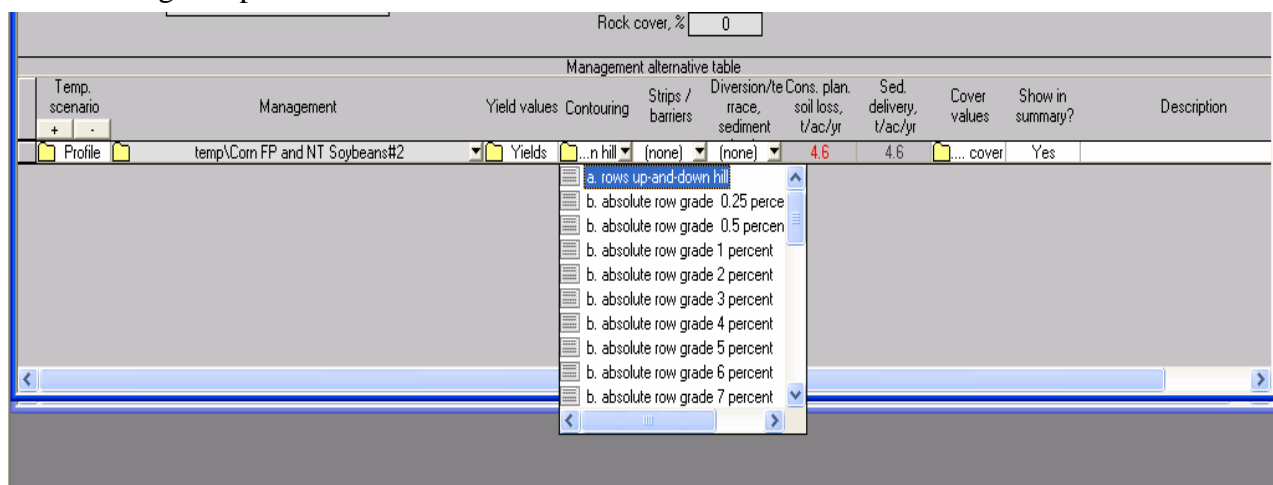

Type in the desired yields here. Then click on the "X" to close

NOTE: If the program will not allow a yield change, go back to the profile view and set the Yield Choice to "Set by User".
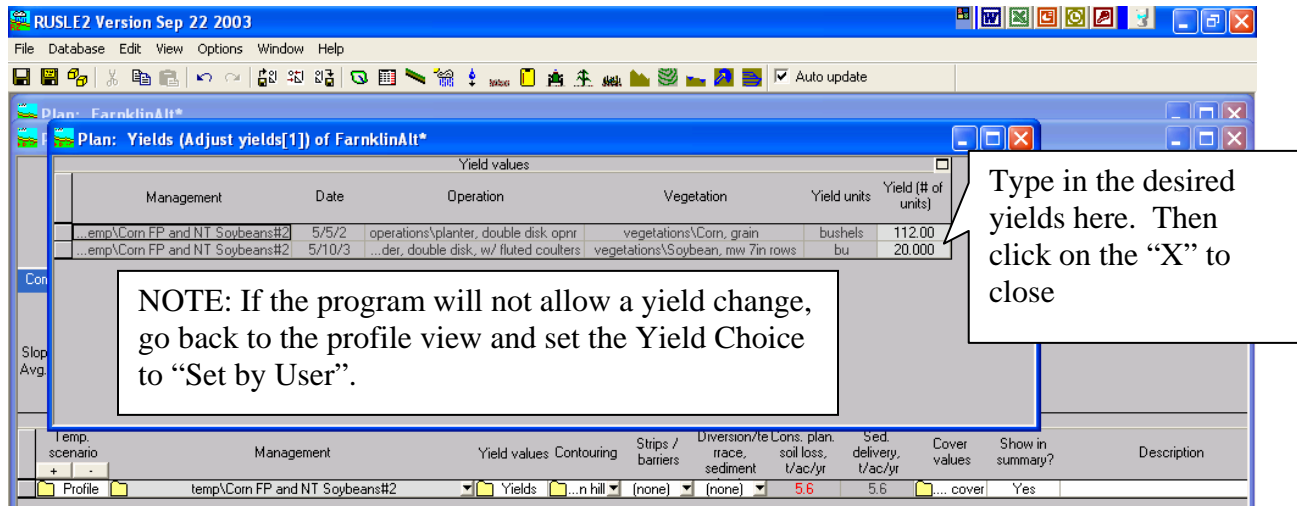
Step 2. CONTOURING – If contouring will be applied enter the appropriate choice using the "contouring" drop down menu.

- Use only the absolute row grades. The row grade means the percent of grade off the contour; e.g. Absolute row grade of 1% means the contouring is actually on a 1% grade across the slope – not on a perfect contour. There is one choice for "On Contour". If contouring is not used, then use the default "up-and-down the hill".

Step 3 – STRIP CROPPING AND CONTOUR BUFFERS.
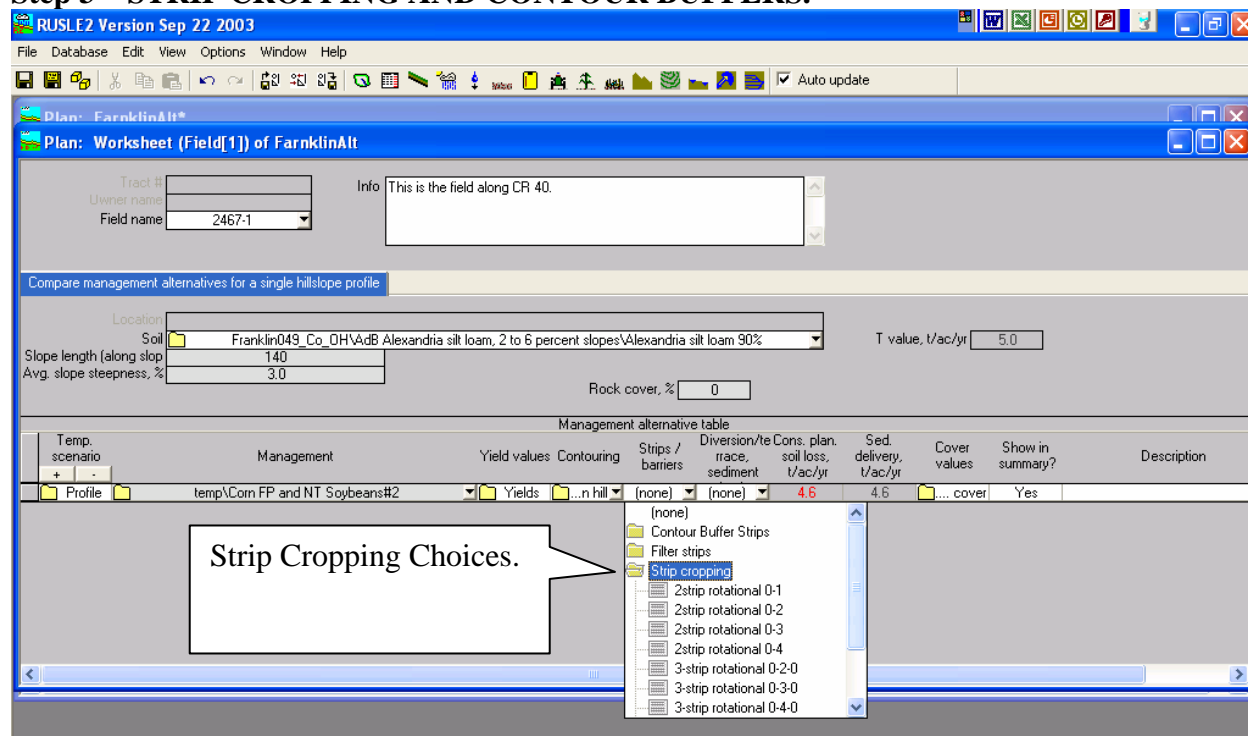
Guidance to select the correct strip cropping choice:
- Unless your slope length is longer than 200 feet you probably only have two (2) strips on the "Length (L)".
- In the choices 2Strip rotational 0-1 means: 2 strips on "L" and the "0-1" means the 1st and 2nd crop in the rotation are next to each other (this would be a two year rotation). In a "0-2" means the 1st and 3rd crops in the rotation are in strips next to each other (this would be a four year rotation like corn-oats-hay-hay where corn and 1st year hay are adjacent or oats and 2nd year hay are adjacent to each other).

Guidance to select Filter Strips (This applies if a filter strip is located at the bottom of the "L"):
- Two Main Choices Are Available – Actual Width or Percent of the "Length".
- Select the width and the type of cover. If you do not find the exact match select a similar choice – most produce very similar results.

Guidance to Select Contour Buffers:

1st Select Actual Width of the Buffer.
2nd Select the number of strips in "L"
3rd Select the type of cover.

Soil Loss for Conservation Planning

Shows the soil loss on the selected "L" and "S". This is the conservation planning value.

This displays sediment delivery at the end of "L".

Adding or Deleting Attributes on the "Worksheet View"

Some of the "attributes" e.g. diversions/terraces are not needed in your location or you may wish to add one to make the worksheet more useful for your location. Attributes can be added and deleted at any time – if you delete on then want to add it back it can be done.

To delete an attribute:

1st Click on an attribute title e.g. Cover Values.

2nd Right click and select – Delete this visual.

To Add and Attribute:

1st. Right click on the words "Management Alternative Table" then select Add Attr.

2nd From the choice list provide from Add Attr select the attribute you wish to add.

In this case Residue Burial Level was added – it appears at the end of the row.
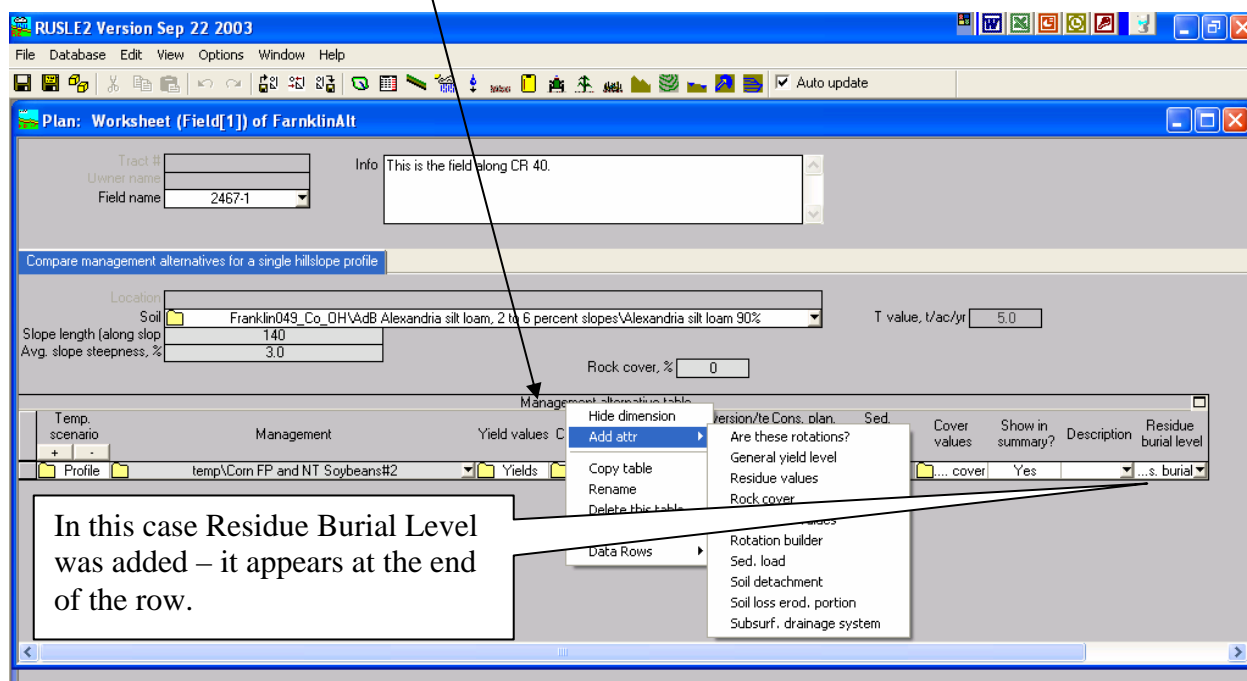
Adjust Residue Burial - Click here to open a choice list to decrease burial or increase burial rate for each field operation.

Use these choices to better match the residue burial percentages for the site specific situations. A selection effects all operations in the rotation.

Adjust Rock Cover - Click here to add the percent of the surface that meets the rock cover criteria (see the section "**Help Rock Cover - Guidelines for Estimating Rock Cover in the Field**" below).

Show in Summary - Select YES to have the results shown on the Plan view screen (previous screen) and your printout report.

Description - Type in a short description of the rotation system. The results will be shown on the Description will be displayed in the printout report.

After you click on the drop down arrow next to "Description" a blank box will be displayed to type in a description – example shown.

Surface Res. Cover Values - Click here will view results of how much residue is remaining after each field operation.

The amount of residue cover is displayed after each operation. These values can be used to document the amount of cover needed for the client residue management plan.

1st Click on the yellow folder next to Cover, then the box above will be displayed..

Soil Condition Index (SCI) and Soil Tillage Intensity Rating (STIR)

Click on the "yellow folder" (SCI) it will open the SCI/STIR dialogue box.

Help: Printing and Saving Reports

After the user has completed data entry and the results are displayed in Worksheet, Plan View, or Profile View the user can print the results and save as a permanent record. The record can be saved as a Microsoft Word (.doc) file anywhere in your file directory. For NRCS and Conservation District users it is suggested you save the file in the client's folder within the Toolkit directory.

To Print the Results, do the Following:

1st. Click on the FILE menu. Select Print to MS Word Template.
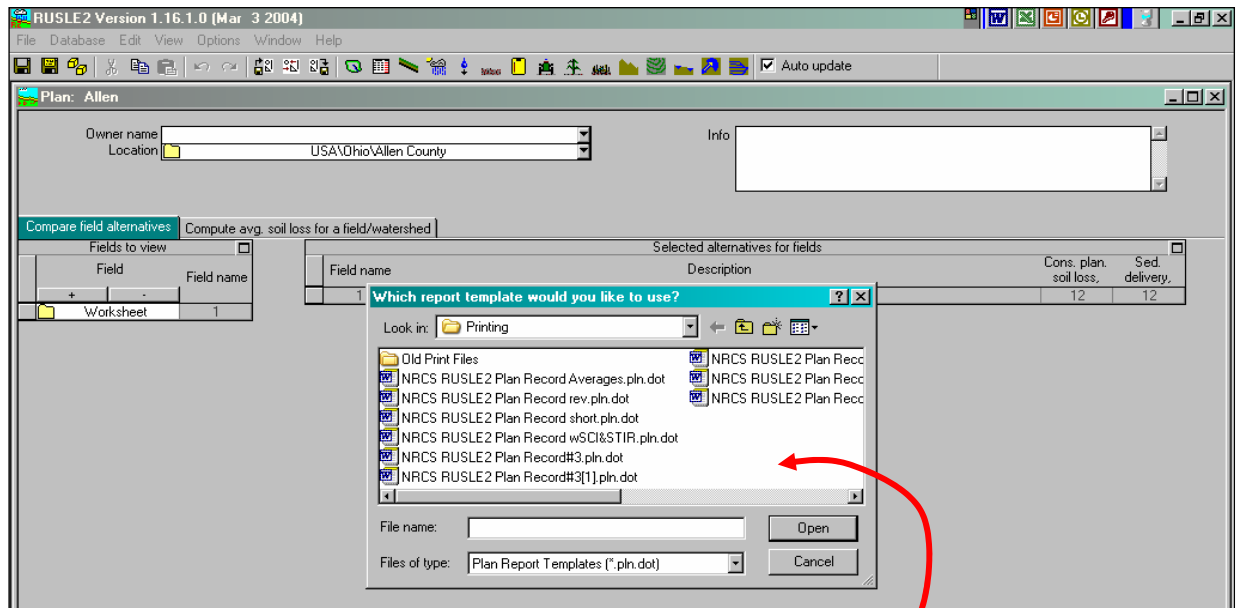
2nd. After the dialogue box appears select the appropriate template.

3rd. Click "OPEN" in the dialogue box. This will open MS Word and display your record of the results.

4th. At this point you have the option of printing and/or saving the document in your file directory. The next page shows an example printout of the four fields used in preparing these instructions.

5th. If you want to save this RUSLE2 run, click the FILE menu and do a SAVE AS. Give it a unique name and SAVE. One should not do this very often as it will take up memory space and could reduce the speed performance of the RUSLE2 program.

Rusle Program Version: Mar 3 2004
Rusle Science Version: 2/4/2004
Data Base: moses

RUSLE2 Erosion Calculation Record

File: plans\Allen
Access Group: R2_NRCS_Sta_Agron

Inputs:
Owner name:
Location: Ohio\Allen County
Info:

Field name	Soil	Slope T Value	Slope length, ft	Slope steepness, %
1	Allen\BoB Blount silt loam, 2 to 4 percent slopes\Blount silt loam 95%	4.0	150	3.0

Results:

Field name	Description	Management	Contouring system	Support practices	Terrace/diversion system	Cons. plan. soil loss, t/ac/yr	Sed. delivery, t/ac/yr	Soil conditioning index (SCI)	STIR value
1	Corn-Soybean rotation. Mulch till corn and no till soybeans.	CMZ 16\c.Other Local Mgt Records\Corn Disk-F Cult, Soybean NT Double Disk	a. rows up-and-down hill	-- none --	-- none --	2.4	2.4	0.34	26

The SCI is the Soil Conditioning Index rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The STIR value is the Soil Tillage Intensity Rating. . It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

Help: Rock Cover - Guidelines for Estimating Rock Cover in the Field

Introduction: The RUSLE2 computer program has an input box on the Profile view screen for *"Rock cover, %"*. This document offers guidelines for making estimates in the field for the percent cover from rock, rock fragments, or coarse fragments. Coarse fragments on the soil surface effect the Cover and Management factor in RUSLE2. Rock cover does not effect the Soil Erodibility factor.

Caution - Use Good Judgement: Research data shows that the presence of rock cover can significantly reduce soil erosion, and the RUSLE2 model accounts for this effect. However, users should be cautioned to exercise good judgement when developing conservation planning alternatives that reflect the presence of surface rock fragments. For example, a rock cover entry in RUSLE2 that reduces soil loss to acceptable levels should be re-considered if the hillslope shows clear evidence of severe, active erosion.

Guidelines for Estimating Rock Cover in the Field

Minimum Size Requirement: Count rock fragments that are larger than 10-mm (0.3937 in, or 2/5 in). On undisturbed land in the western U.S., count rock fragments that are larger than 5-mm (0.19685 in, or 1/5 in). Professional judgement is needed when rocks are flat or light in weight. The defining criteria are whether it is easily moved by runoff during a storm event.

NOTE: States should develop practical field measurement guides for minimum size requirements of rock fragments. Field users should be encouraged to use (or should be given) a practical tool for use in measuring the 10-mm or 5-mm size. This could be a drill bit, stove bolt, plastic ruler or a paper scaled-drawing. For the 10-mm size, the minimum size rock should be slightly larger than a 3/8-in drill bit, or slightly smaller than a ½-in drill bit; and for the 5-mm size, the minimum rock size should compare with the ¼-in drill bit. Where rock fragments are flat, a conversion should be developed at the state level, since the 10-mm and 5-mm size in these requirements are meant to apply to a more rounded or blocky shape. Dimensions for flat rock measurement should take into account comparable weight of blocky or rounded rock vs. flat rock, keeping in mind the ability of the flat rock to remain in place and reduce runoff during a storm event.

Most Erosive Period: The estimate of rock cover should represent the range in rock cover over the 3 or 4 month period that is most erosive. "Most erosive" should include consideration of both the period of highest rainfall erosivity and the vulnerable management period. Since field measurements cannot always be made during this period, additional guidelines may need to be issued by the state.

Measuring Rock Cover: Whenever possible, measure rock cover using the line-transect method.

Rock Cover on Entire "L": The percent rock cover should be based on the entire eroding hillslope profile, or "L". We are evaluating soil loss on the entire RUSLE2 hillslope profile.

Avoid overestimating the rock cover based on a segment of the slope that contains the largest percent of rock cover.

Represent Field or Portion Thereof: Adjust the rock cover estimate to represent the field or portion of the field represented by the hillslope profile <u>if</u> rock cover is significantly more or less on the representative hillslope compared to the rest of the field.

Ignore Overlap with Residue: When measuring or estimating rock cover, ignore any overlap with residue cover**.** Count the surface rock cover even if it lies above or below residue. RUSLE2 takes into account the overlap of different types of ground cover. For example, if rock cover is 15% and corn stalks provide 40% cover, the total cover considered by RUSLE2 is 49%. RUSLE2 properly takes into account the nonlinear mathematics of the combination of rock cover and crop residue.

NOTE: This User's Guide for the RUSLE2 program was created by **Norm Widman**, Conservation Agronomist, USDA-Natural Resources Conservation Service, Columbus OH.